



Environmental Energy Technologies Division

Lawrence Berkeley National Laboratory

Module 2

Technical Working Group Meeting

May 20, 2014

- **Forum**
 - Topics are posted, members can post replies
 - Members can add new topics
- **Email BEDES-TWG@lbl.gov**
 - All Forum members receive the email
- **Add Comments to Spreadsheet**
 - Everyone is looking / commenting on the same doc
 - How to add comments
- **Email Robin (RDMitchell@lbl.gov)**

Overview of Module 2 – Schedule

Module 2 Technical Working Group Bi-Coastal Meeting	June 16
Forum Postings/ Feedback	June - July
Module 2 Technical Working Group Call	July 17
Forum Postings/ Feedback	July - August
Module 2 Draft for Review	Mid-August
Forum Postings/ Feedback	August –September
Final Review Technical Working Group Bi-Coastal Meeting	September 8
Final release of 1.0	September 30

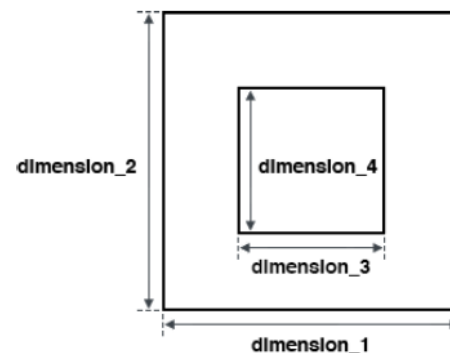
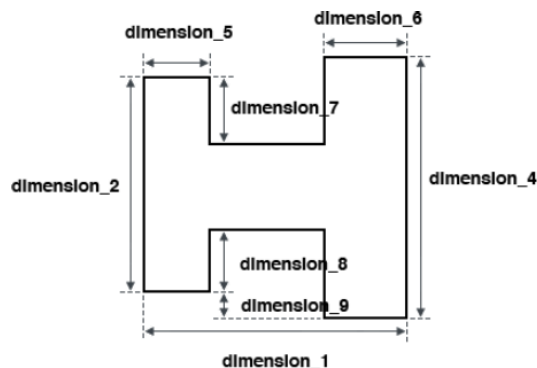
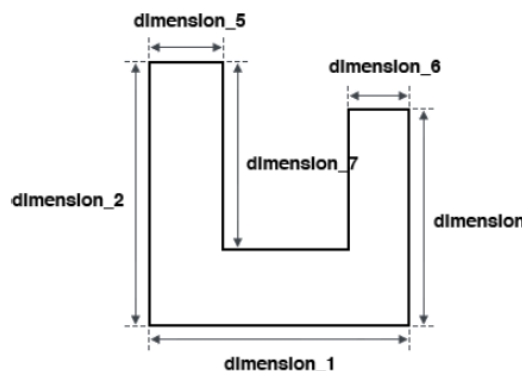
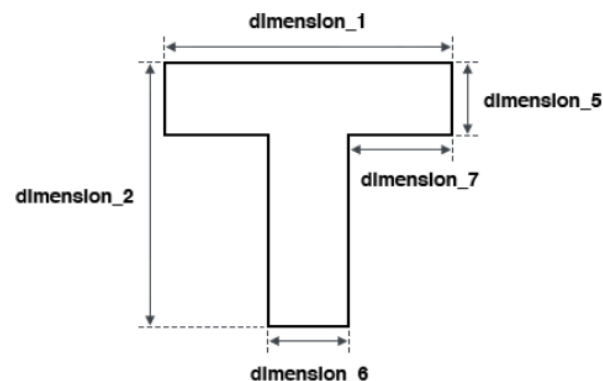
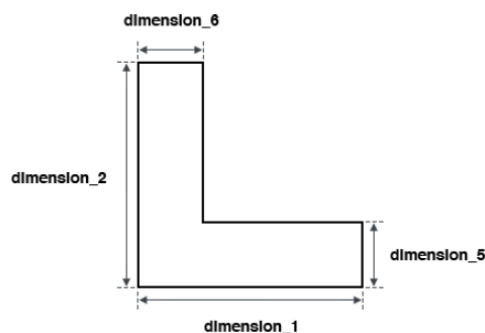
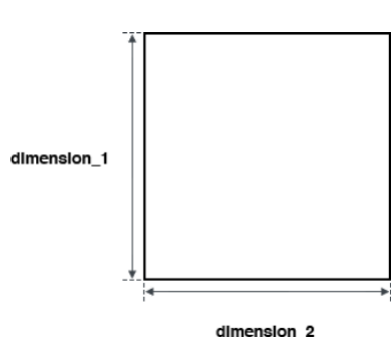
1. Envelope
2. Controls and Operations
3. HVAC
4. Process Loads
5. Internal Equipment Loads
6. Energy Generation and Storage
7. Measures

- **What implementations care about envelope?**
 - **BPD**
 - **Audits / Detailed characterizations**
 - **Commercial Asset Score Tool (CAST)**
 - **Most detailed information**
 - **Simulation (E+)**
 - **NREL Audit Use Case** (combined CAST/HPXML/BEDES)
 - **Home Energy Score (Single Family)**
 - **Simulation (DOE2)**
 - **HPXML**
 - **IEP**
 - **AIA 2030 – Design / New Construction**
 - **Simulation (via CAST)**

- Complexity – BEDES needs to cover all levels
 - Simple
 - BPD
 - Moderately complex
 - AIA
 - AUC
 - HPXML
 - IEP
 - Complete enough to do a simulation
 - CAST
 - HES (SF)

- **Building Geometry**
 - Enough detail to be useful
- **Surfaces**
 - Walls, Roof, Floor relative (or not) to the geometry
- **Construction of surfaces**
 - Insulation level
- **Fenestration**

- **Commercial Asset Score Tool**
 - Most detailed geometry definition
 - Also need Circular & V-shaped (?)
 - Should BEDES adopt this ? By reference ?



- Commercial Asset Score Tool

Table 3. Block Object Fields

Field	Type	Description
id	Integer	The unique identifier for this block.
name	String	A custom name given to the block. This name is displayed in the user interface.
shape_id	Integer	ID corresponding to a specific block shape: 1. Rectangle 2. Courtyard 3. H-shape 4. L-shape 5. T-shape 6. U-shape
dimension_1	Float	These dimension values change depending on the shape being used. See Figure 2 through Figure 7.
dimension_2	Float	
dimension_3	Float	
dimension_4	Float	
dimension_5	Float	
dimension_6	Float	
dimension_7	Float	
dimension_8	Float	
dimension_9	Float	
created_at	Datetime	Date and time the user account was created in the Energy Asset Score application.
updated_at	Datetime	Date and time the user account was updated in the Energy Asset Score application.
number_of_floors	Integer	Number of above ground floors included in the block.
number_of_bg_floors	Integer	Number of below ground floors included in the block.
floor_to_floor_height	Float	Distance between floors, including any drop ceiling space.
has_drop_ceiling	Boolean	Value should be true if the floors within this block include a drop ceiling.
floor_to_ceiling_height	Float	Distance between the floor and ceiling, not including any drop ceiling

- **Commercial Asset Score**
 - **Concept of Blocks** defining the building or any part of a building
 - **Blocks == Premises**
 - **Geometric shape / area**
 - **Surfaces (Walls, roof, floor)** are defined
 - **Fenestration** is defined
 - **Floors** (currently in Premises):
 - **Number of Floors**
 - **Above & Below Ground**
 - **Floor to ceiling / Floor to floor height**

- Premises with geometry
 - Define as few or as many as needed

Commercial Asset Score
Block Definition


☒ Above Ground ☐ Below Ground

*Number of Floors

*Avg. Floor-to-Floor Height ft

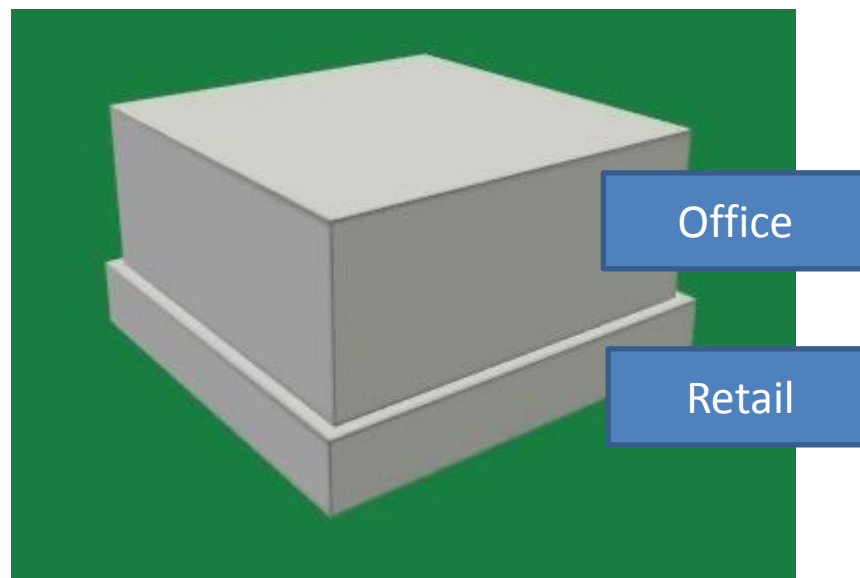
*Avg. Floor-to-Ceiling Height ft

*Orientation ° from North



*ft

*ft



- **Opaque Envelope Surfaces**
 - **Currently:**
 - **Exterior Wall**
 - **Roof/Ceiling**
 - **Foundation**
 - **Change to**
 - **Opaque Envelope Surfaces**
 - **Surface Characterizations**

- Exterior Wall Type –
 - w/R-value or may be the only input
- Thermal performance characterization ?
- Simplify ? Make more generic to apply to all surfaces

BEDES Beta	
Brick	Masonry
Brick Cavity	Frame Wall
Stone	Frame Wall and Masonry
Concrete - Uncategorized	Curtain Wall
Concrete - Panels	Window Wall
Concrete - Block	Slab Edge
Concrete Poured	Continuous Angle
Concrete Non-Load Bearing	SIPS
Concrete Load Bearing	EIFS and Masonry
Concrete - Insulated Forms	EIFS
Concrete - Aerated	Wood Walls
Metal - Uncategorized	Siding or Shingles
Metal Panels	Other / Combination
Sheet Metal	Unknown

CAST
1. Metal panel / curtain wall
2. Siding on wood frame
3. Brick / Stone on wood frame
4. Brick / Stone on steel frame
5. Brick / Stone on masonry

HPXML
Structural Brick
Stone
Concrete Masonry Unit
Solid Concrete
Steel Frame
Structurally Insulated Panel
Wood Stud
Double Wood Stud
Log Wall
Straw Bale
Other

- **R-value vs U-factor**
 - Various implementations have one or the other or both
 - U-factor is for whole assembly, including film coefficients (inside/outside)
 - R-value may or may not be for the whole assembly
 - Used to define insulation only
 - CEC has “effective R-value” which is for whole assembly, includes air films

Envelope: Surfaces

★	Opaque Envelope Surface	Exterior Wall Ceiling Roof Floor Foundation Wall	
★	Construction Description	Giant list (Concrete/wood frame, etc)	
★	Exterior Exposure	Above Ground (Air) Below Ground (Ground) Adjacent structure	
★	Interior Exposure	Conditioned space Unconditioned space	AUC / New
★	Surface Area	Decimal	BEDES / CEC
★	Azimuth	Decimal	New
★	Cardinal Orientation	North South East West	BEDES
★	Effective R-value	Decimal	BEDES / CEC
★	Color	White / Light / Medium / Med-Dark / Dark	BEDES
★	Solar Absorptance	Decimal	AUC / CEC
★	Thermal Absorptance (Emittance)	Decimal	AUC / CEC
★	Interior Visible Absorptance	Decimal	AUC / CEC
★	Exterior Roughness		AUC / CEC

★
Minimal Input

★
More Complete Input

★
Most Complete Input

Envelope: Surface Finish / Framing

★	Exterior Surface Finish	Wood Stone Brick Masonry Metal Shingles (wood, asphalt, asbestos)	New
★	Framing Material	Metal Wood Concrete Brick Masonry None	CEC
★	Framing Spacing	Decimal	CEC (Configuration)
★	Framing Depth	Decimal	CEC
★	Framing Factor (% framing)	Decimal	CEC



**Minimal
Input**



**More
Complete
Input**



**Most
Complete
Input**

Envelope: Surface Insulation

★	Insulation Application Type	Loose Fill Batt Spray-on Rigid	BEDES / New
★	Insulation Material	Fiberglass Cellulose EPS XPS	New
★	Insulation Thickness	Decimal	BEDES
★	Insulation Continuity	Continuous	HPXML
		Cavity	
★	Insulation Condition	Excellent / Good / Average / Poor	HPXML
★	Insulation Location (relative to framing?)	Inside / Outside	HPXML
★	Insulation R-value	Decimal	BEDES

★
**Minimal
Input**

★
**More
Complete
Input**

★
**Most
Complete
Input**

- **Home Energy Saver (Single Family) (DOE2 Simulation)**
 - **Insulation definition**
 - **Conductivity**
 - **Density**
 - **Specific Heat**
 - **Resistance (per unit thickness)**
 - **Could apply to any material**

- **Fenestration Type**
 - **Window**
 - **Curtain wall**
 - **Skylight**
 - **Glass Door**

Envelope: Fenestration

★	Fenestration Type	Window / Skylight / Door / Curtainwall	
★	Fenestration Area	Decimal	
★	Fenestration Height	Decimal	CAST
★	Fenestration Width	Decimal	CAST
★	Sill Height	Decimal	CAST
★	Operable	Boolean	BEDES
★	Operable area	Decimal	New
★	Tilt	Decimal	AUC / HPXML
★	Azimuth	Decimal	
★	Cardinal Orientation	North/South/East/West	HPXML
★	Window to Wall Ratio	Decimal	BEDES / CAST
★	Number of glass layers	Integer	AUC / AIA / IEP / HPXML
★	Glazing System Layer Description	Single / Double / Triple / Multi-pane / Unknown	BEDES
Whole Product Characterizations			
★	U-factor	Decimal	
★	Solar Heat Gain Coefficient	Decimal	
★	Visible Transmittance	Decimal	



**Minimal
Input**



**More Complete
Input**

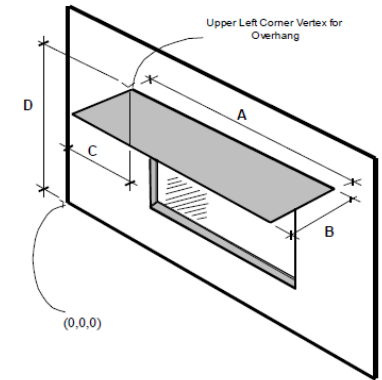


**Most Complete
Input**

Envelope: Fenestration

Fenestration Glass	Clear uncoated	$T_{vis} \geq 0.85$, $T_{sol} \geq 0.69$, $E_{miss} \geq 0.83$, ≤ 0.85 , Thick ≥ 1 mm
Add criteria	Low-e	$T_{sol} \geq 0.5$, $E_{miss} \leq 0.30$, Thick ≥ 1 mm
	Tinted	$E_{miss} \geq 0.83$, ≤ 0.85 , Thick ≥ 1 mm
	Tinted + Low-e	$E_{miss} \leq 0.30$, Thick ≥ 1 mm
	Reflective	$T_{vis} < 0.30$, $R_{sol} > 0.135$, $E_{miss} < 0.80$, Thick ≥ 1 mm
	Reflective on Tint	$T_{vis} < 0.20$, $T_{sol} < 0.20$, $R_{sol} > 0.135$, $E_{miss} < 0.80$, Thick ≥ 1 mm
	High Performance Tint	$E_{miss} \geq 0.83$, ≤ 0.85 , $T_{vis}/T_{sol} \geq 1.5$, Thick ≥ 1 mm
	Sunbelt Low-e (low SHGC)	$T_{sol} < 0.50$, $E_{miss} \leq 0.30$, Thick ≥ 1 mm
	Suspended Film	Thick < 0.5 mm
Fenestration Gas fill	Air	
	Argon	
	Other	
	Unknown	
Fenestration Frame	Metal	
Is this grouping right ?	Metal with Thermal Break	
	Vinyl	
	Wood / Wood Clad	
	Fiberglass/Composite	

- Interior / Exterior Shading Systems
 - More detail than just a list for simulating?
- Exterior Fixed Shading
 - Detail of CAST
(defining exact location and size of shades)



Interior Shading System	Blinds Curtains Shades Light Shelf (Interior ??) None Other	BEDES CAST
Exterior Shading System	Louvers Solar Screen Solar Film Awning Other	BEDES / HES-SF / HPXML
Exterior Fixed Shading	Overhang Fin	CAST / HES-SF

- Classification
- Savings
- Costs
- Other

How do we categorize measures?

- Type
 - Replacement
 - Modification
 - Addition
 - Removal
- Technology Category (1-20)
 - Lighting, HVAC...
- Flexible to be applied at any levels (Site, Facility, Building, System, equipment.)

Measures: Classification-FEMP Technology Categories

TC	Description
1	Boiler Plant Improvements
2	Chiller Plant Improvements
3	Building Automation Systems/Energy Management Control Systems (EMCS)
4	Heating, Ventilating, and Air Conditioning
5	Lighting Improvements
6	Building Envelope Modifications
7	Chilled Water, Hot Water, and Steam Distribution Systems
8	Electric Motors and Drives
9	Refrigeration
10	Distributed Generation
11	Renewable Energy Systems
12	Energy/Utility Distribution Systems
13	Water and Sewer Conservation Systems
14	Electrical Peak Shaving/Load Shifting
15	Energy Cost Reduction Through Rate Adjustments
16	Energy Related Process Improvements
17	Advanced Metering Systems
18	Appliance/Plug-load reductions
19	Commissioning Measures
20	Other

- List of measures (BCL, AUC, FEMP ESPC..)
- Measure numbering system?

AB - **CD** - **EFGH**

AB	Type
RP	Replacement
MD	Modification
AD	Addition
RM	Removal

CD	Technology Category
01	Boiler Plant Improvements
02	Chiller Plant Improvements
18	Appliance/Plug-load reductions
19	Commissioning Measures

EFGH	Measure
1001	Boiler
1002	Steam traps
..	
...	
..	

- How do we capture pre-retrofit and post retrofit system conditions?
- Pre-retrofit and Post Retrofit consumption
- Savings
 - Resource Savings (native units- kwh, therms..)
 - Cost Savings
 - Non Energy Cost Savings
 - Incentives
 - RECs

- Total Implementation costs
 - Do we need more granular costs? (material, installation..)
- Annual costs
 - Operation & Maintenance
 - Principal and Interest?
 - Measurement & Verification?
- Additional fields?
 - Frequency of savings/costs
 - Life of system/equipment
 - planned replacement schedule,
 - depreciation, salvage value, disposal costs..

- Measure Scope
 - Percentage of the building floor space affected
- Measure Size?
 - Determines the scale of measure
 - Kw of lighting, Tons of Chiller

On-Site Energy Generation Type

- PV
- Fuel Cell
- Microturbine
- Turbine
- Cogeneration
- Plasma Gasification
- Generator
- Solar thermal
- Geothermal
- Biomass
- Hydrothermal
- Wind
- Reciprocating engine
- Other
- Unknown
- Biogas*
- Natural gas*
- Hydro*
- Solar Parabolic Trough*

On-Site Energy Generation Technology

- Resource Input Type
 - Wind
 - Natural Gas
 - Biogas
 - Water
 - Steam
- Resource Output Type
 - Electricity
 - Thermal Energy

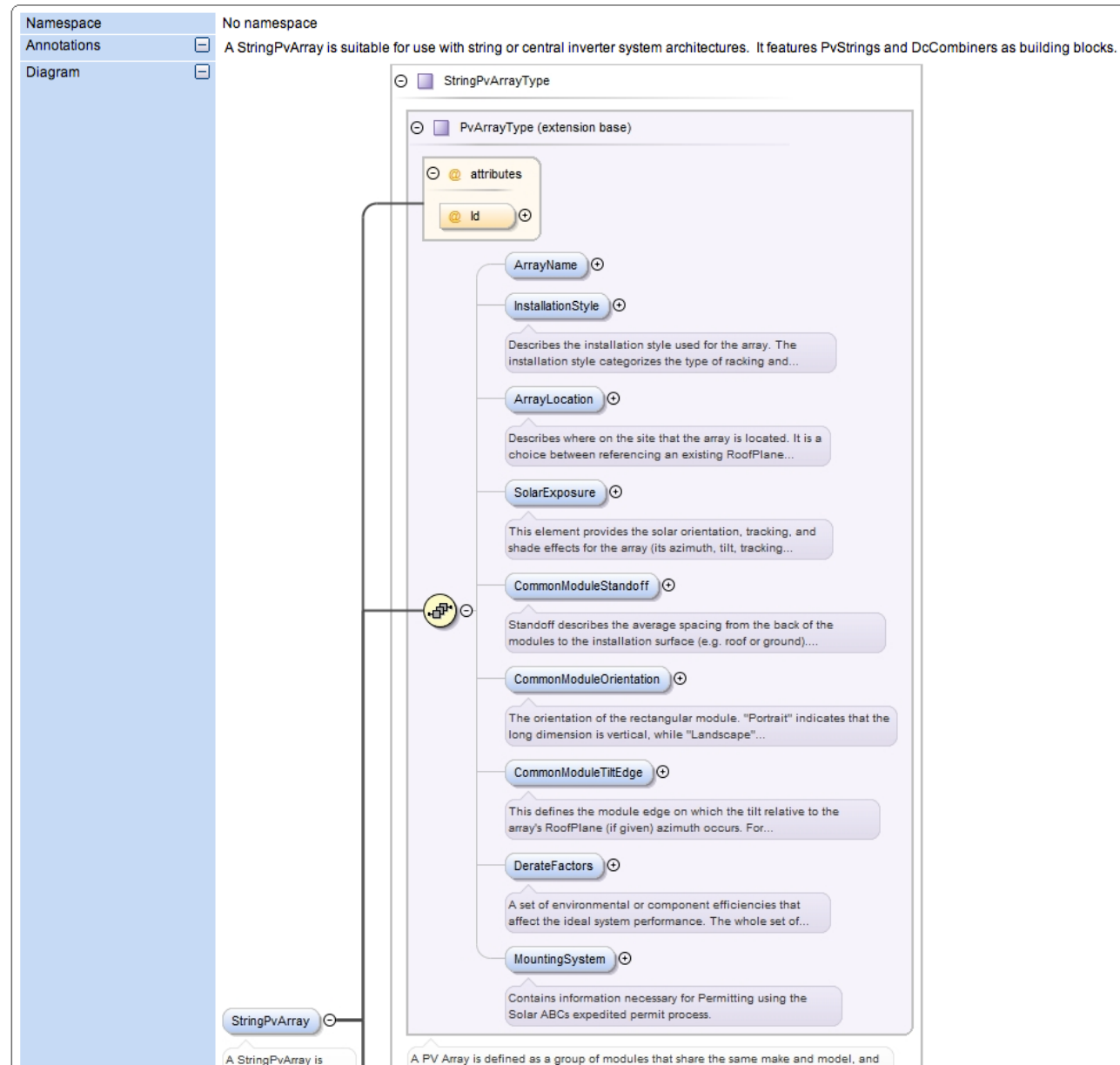
- On-Site Energy Generation Technology
 - Turbine
- Resource Input Type
 - Wind
- Resource Output Type
 - Electricity

- Previous version of BEDES-Beta contains the following level of detail:
 - Quantity
 - Capacity
 - Capacity Unit
 - Annual Operation Hours
 - Year of Manufacture
 - Used for Demand Response
 - DC Rating
 - Derate Factor
 - PV Array Tilt
 - PV Array Azimuth

Element PowerPointTrackerType / StringPvArray

Example:

- IEP's existing level of information.



- Also include:
 - Manufacturer
 - Model Number
- What level information should we include for different technologies? E.g., Wind, PV, CSP, etc.

- Energy Storage Technology
 - Battery
 - Ice Storage
 - Chilled Water Storage
 - Other / Combination
 - Unknown
 - Pumped Hydro*
 - Fly Wheel*
 - Thermal*
 - Compressed Air*
 - Emerging Technology?
 - E.g. synthetic natural gas, electrochemical capacitors, etc.

- Is this enough information on storage characteristics?
 - Quantity
 - Capacity
 - Capacity Unit
 - Percent of Total Installed Capacity
 - Year of Manufacture
 - Location
 - Fuel (resource input/output)

- Operation
- Schedules
- Controls
- Maintenance

- Operator Type
- Operator Certification, Number, State
 - BOC, BPI, None, Other, Unknown
- Operation Event
 - Meals Served, Laundry Processed, Ice Performances, Sporting Events, Non-Sporting Event, Other
- Operation Events per Year
- Any more information on operation missing?

- Current Level of Detail—Annual business hours
- Proposed Level of Detail—Daily schedule categories:
 - Business, occupancy, public access, HVAC, lighting, other equipment.
- Highest Level of Detail—Hourly status schedules for equipment.

- Control Technology
 - Pneumatic Thermostat
 - Programmable Thermostat
 - Thermostatic Radiator Valve
 - Electronic Zone Valve
 - Demand Control Ventilation
 - Occupancy Sensor
 - Vacancy Sensor
 - Photo Sensor
 - EMCS
 - BMS
- Primary Control Strategy
 - (T/F)
 - Percent of Area Controlled
 - Setpoint Type:
 - Cooling
 - Heating
 - Humidity
 - Pressure
 - Flow
 - Setpoint Low
 - Setpoint High

- Maintenance Type
 - Inspection
 - Cleaning
 - Repair
 - Replace
 - Other
 - Monthly
 - Semi-Quarterly
 - Quarterly
 - Semi-Quarterly
 - Annually
 - Unknown
- Frequency
 - As Needed
 - Daily
 - Weekly
 - Bi-Weekly
- Maintenance Events per Year
- Date of most recent Event

- **Compatibility**
 - Mapping of existing schema to BEDES dictionary
 - Reviewed and approved by BEDES host
 - Published on BEDES site
- **Compliance**
 - Export of transaction schema based on use case